

NON-PUBLIC?: N
ACCESSION #: 9202260086
LICENSEE EVENT REPORT (LER)

FACILITY NAME: Brunswick Steam Electric Plant PAGE: 1
Unit 1

DOCKET NUMBER: 05000325

TITLE: PRIMARY UNINTERRUPTIBLE POWER SUPPLY INTERNAL FAILURE
RESULTS IN
REACTOR SCRAM
EVENT DATE: 01/17/92 LER #: 92-03-0 REPORT DATE: 02/18/92

OTHER FACILITIES INVOLVED: BSEP UNIT 2 DOCKET NO: 05000324

OPERATING MODE: 1 POWER LEVEL: 100

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR
SECTION:
50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:
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Compliance Specialist

COMPONENT FAILURE DESCRIPTION:
CAUSE: X SYSTEM: EF COMPONENT: ASU MANUFACTURER: C782
REPORTABLE NPRDS: Y

SUPPLEMENTAL REPORT EXPECTED: NO

ABSTRACT:

At 0852 on January 17, 1992, Unit 1 reactor was operating at 100% steady state reactor power. Unit 2 was at 85% reactor power. Unit 1 and 2 Emergency Core Cooling Systems (ECCS) were operable.

Unit 1 Uninterruptable Power Supply (UPS) sustained momentary voltage losses due to failures in the Primary UPS static switch which prevented automatic and manually initiated electronic transfers of the UPS loads to the alternate source. The loss of Unit 1 UPS resulted in the common stack radiation monitor initiating a Primary Containment Isolation System (PCIS) Group 6 isolation (Containment Atmosphere Control), Reactor Building Ventilation Isolation, and Standby Gas Train (SBGT) initiations on both Units. On Unit 1, the reactor vessel water level decreased as a

result of the reactor feed pump control system runbacks with a loss of UPS and with speed control lockouts occurring when the UPS voltage returned. Reactor vessel level passed the Low Level (LL) #1 (162.5") setpoint and momentarily the LL #2 (112.5") setpoint. These initiated a reactor scram and the following PCIS isolations signals: Group 2 (Drywell Floor and Equipment Drains), Group 3 (Reactor Water Cleanup), Group 6, and a Group 8 (Residual Heat Removal). At LL #2, High Pressure Coolant Injection (HPCI) and Reactor Core Isolation Cooling (RCIC) initiated and injected into the reactor vessel until they tripped on high reactor vessel level (210"). Over the next hour, the UPS system continued to experience isolated momentary periods of unstable operation, resulting in multiple Group 6 isolation signals from the stack radiation monitor. At 0922 and 1017 additional reactor vessel LL #1 signals were generated due to difficulties experienced with maintaining stable reactor vessel level control.

This isolated UPS failure is of minimal safety significance as UPS is classified as non-safety related and the plant responded as designed.

END OF ABSTRACT

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INITIAL CONDITIONS

At 0852 on January 17, 1992, Unit 1 reactor was operating at 100% steady state reactor power. Unit 2 was at 85% reactor power. The Unit's Emergency Core Cooling Systems (ECCS) were operable.

EVENT NARRATIVE

Unit 1 Primary Uninterruptable Power Supply (UPS) loads sustained momentary voltage losses and initiated the events listed in the attached sequence of events. The Cyberex Inc. model 50/2B3 UPS system supplies power to various plant monitoring devices including the main turbine supervisory system and Electro-Hydraulic Control (EHC) panel, Control Rod Drive (CRD) position information, stack gas radiation monitor, and miscellaneous process instrumentation.

The loss of UPS resulted in the stack radiation monitor deenergization initiating a Group 6 isolation (Containment Atmosphere Control), reactor building ventilation isolation, and Standby Gas Train (SBGT) initiations on both Units 1 and 2. This was the only consequence the Unit 1 UPS failure had on Unit 2. On Unit 1 the momentary loss of UPS caused the full core display to suddenly blackout. When UPS reenergized all the control rod drift lights were energized along with the control rod "Full

Out" lights.

The Unit 1 reactor vessel water level began decreasing as the momentary loss of UPS resulted in reactor feed pump (RFP) runbacks until the RFP control signal lockouts were reenergized. Unit 1 scrambled on Low Level (LL) #1 (162.5") at 0852. The LL #1 also initiated Primary Containment Isolation System (PCIS) Group 2 (Drywell Floor and Equipment Drains), Group 6, and Group 8 (Residual Heat Removal) isolation signals. The Group 6 isolation was already present due to the stack radiation monitor signal, and the Group 8 isolation is sealed-in at normal reactor operating pressures. The reactor vessel level reached LL #2 (112") resulting in High Pressure Coolant Injection (HPCI) and Reactor Core Isolation Cooling (RCIC) initiations, and a Group 3 (Reactor Water Cleanup) isolation. Both HPCI and RCIC momentarily injected into the vessel until they tripped on high reactor vessel level (210"). The reactor recirculation (RR) pumps tripped at 0852 when the manually initiated main turbine trip caused the site electrical loads to transfer to the Startup Auxiliary Transformer (SAT) from the Unit Auxiliary Transformer (UAT). The 4160 volt 1B Bus which powers the RR pumps does not automatically transfer from UAT to SAT.

Unit 2 needed to restore the Unit 2 reactor building ventilation in order to maintain the Main Steam Line area temperatures below the Group 1 (Main Steam Line Isolation Valves) isolation setpoints. At 0856, the Emergency Operating Procedures (EOPs) were used to override the stack radiation monitor induced Group 6 isolation signal.

Over the next hour, the Primary UPS continued to experience isolated momentary periods of unstable operation, resulting in multiple stack radiation monitor initiated Group 6 isolation signals. During this time operations personnel unsuccessfully attempted to manually initiate an electronic transfer of the UPS loads from the Primary UPS to the Alternate source, which also resulted in momentary unstable UPS operation. Troubleshooting later determined that the Static Transfer Switch, which was needed for automatic and manually initiated electronic transfers, had failed.

The unstable UPS operation affected EHC and resulted in main turbine bypass valve oscillations. While plant parameters remained under control, these oscillations caused the reactor pressure to cycle and potentially jeopardized the continued use of the main condenser as a heat sink. To stop these oscillations, the EHC pumps were secured at 0921 when the remaining plant steam loads were adequate to control reactor pressure.

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At 0922, another reactor vessel LL #1 signal was generated due to the continuing erratic operation of UPS, which prevented the reactor feed pumps from maintaining a stable reactor vessel level. Stable reactor vessel level control was also hindered by the erratic response of the feedwater Startup Level Control Valve (SULCV). The valve positioner response was affected by corrosion products in its instrument air supply. At 0941, UPS again cycled resulting in a Group 6 isolation. At this point UPS became reasonably stable and attempts to manually transfer from the Primary UPS were put on hold until a suspected fault on the Alternate source was determined not to exist. RCIC was manually started to restore and maintain level control. At 0958 the RCIC system was shutdown and level control was to be maintained with the CRD system supplemented by a RFP as needed.

At 1017, reactor vessel level control decreased to the LL #1 setpoint, before a RFP could be restarted. This resulted in another RPS trip signal, and Group 2, 6, and 8 isolation signals. The Group 6 isolation valves had been reset, but this isolation was not identified in the second red phone report that was made at 1248. An additional red phone report was made at 1608 to identify the 1017 isolation. The "1B" RFP was placed in service to feed the reactor vessel through the Startup Level Control Valve. Normal level control was established.

At 1503, the Manual Bypass Switch was used to transfer UPS loads to the Alternate source.

CAUSE OF EVENT

The Primary UPS troubleshooting identified two component issues that would account for the loss of UPS:

- 1 The "A"-phase Modulation Index Control (MIC) circuit board capacitor failure resulted in the inverter output waveshape being distorted.

- 2 The static switch was not functioning properly and would not transfer on demand. The static switch malfunction was determined to be isolated to the synchronizer module transfer inhibit circuit. Improper output of this module prevented the static switch from transferring. The vendor has indicated a previous failure with this inhibit circuit and an up-graded replacement circuit is available. This information was not made available to the industry prior to CP&L's UPS event.

With these component failures one of two scenarios occurred:

1 The static switch function failed (at some previous time) but was not challenged until failure of the "A"-phase MIC board (which resulted in a degraded inverter output). When a MIC board failure occurred in the past the Static Switch functioned properly and transferred to the alternate source as designed without loss of UPS.

2 The Static Switch function failed, resulting in the immediate failure of a MIC card, which coupled together resulted in a failure of the UPS supply.

CORRECTIVE ACTIONS

- The Standby UPS was placed in service prior to Unit 1 reactor startup.
- A marginal SCR firing board and the failed MIC board have been replaced and an acceptable output wave shape has been demonstrated on the Primary UPS.
- During the April 1992, Unit 1 surveillance outage additional troubleshooting will be

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conducted on the primary UPS.

- Replacement of the static switch synchronizer module transfer inhibit circuits with an up-graded component is being evaluated for both Units.
- A review of the UPS operating procedures will be conducted to address recovery from situations where component failure may require temporary de-energization of UPS, manual transfers, or the use of the Manual Bypass Switch.
- Investigate improvements to the UPS annunciator procedures that will give a more complete list of indications and plant responses on a loss of UPS.
- The feedwater SULCV positioner has been repaired and returned to service. An evaluation of the SULCV's susceptibility to the fine corrosion particles that are getting through the installed filter will be performed.

SAFETY ASSESSMENT

The safety significance of this event is minimal since the UPS system is classified as non-safety related. The Unit 1 ECCS systems responded as required. The loss of UPS did not prevent monitoring of critical plant parameters.

PREVIOUS SIMILAR EVENTS

No similar events were identified.

EIIS COMPONENT IDENTIFICATION

System/Component EIIS Code

Uninterruptible Power System / Switching Unit Automatic EF
Primary Containment Isolation System JM
Reactor Core Isolation Cooling System BN
Standby Gas Treatment System BH
Reactor Protection System JE
Startup Level Control Valve SD/LCV
Reactor Recirculation System RR
Feedwater Level Control System JK
High Pressure Coolant Injection System BJ
Process Computer IO/CPU

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UNIT 1 SEQUENCE OF EVENTS

DATE 1/17/92

08:52:10 THE "ERFIS" COMPUTER STARTED TO RECEIVE A SERIES OF ALARMS THAT WOULD TRIP AND RESET

ALARMS RECEIVED WERE:

GROUP 6 ISOLATION COMMAND- ISOLATION
REACTOR FEED PUMP (RFP) "A" CONTROL
SIGNAL FAILURE - TRIP
MAIN TURBINE TRIP STATUS - TRIP (NOT
VALID)

- THESE ALARMS INDICATED SUBSTANTIAL VOLTAGE VARIATIONS IN THE UNINTERRUPTABLE POWER SUPPLY (UPS)

THE FULL CORE DISPLAY SUDDENLY WENT BLACK AND THEN DISPLAYED DRIFT LIGHTS FOR ALL CONTROL RODS, HOWEVER THE FULL OUT LIGHTS CAME BACK ON

ROD POSITION INFORMATION SYSTEM (RPIS) IS POWERED BY UPS

IN THE CONTROL ROOM, BOTH RFP TURBINE CONTROL SYSTEMS LOCKED OUT (ON THE RFP CONTROL SYSTEM FAILURE) AND WOULD NOT RESPOND TO OPERATOR ACTIONS

BOTH REACTOR RECIRCULATION (RR) PUMPS EXPERIENCED A SCOOP TUBE LOCKOUT

"ERFIS" COMPUTER TRACES SHOWED A STEADY DECREASE IN REACTOR LEVEL WITH AN APPROXIMATELY CONSTANT POWER

REPEATED MOMENTARY LOSSES OF THE UPS POWER WOULD ACCOUNT FOR ALL OF THE SYMPTOMS OBSERVED

08:52:34 REACTOR SCRAM, GROUP 2, 6, AND 8 ISOLATION SIGNALS RESULT FROM REACTOR VESSEL LOW LEVEL #1

08:52:41 A MANUAL TURBINE TRIP IS INSERTED. CLOSURE OF TURBINE VALVES CREATES A GENERATOR BACKUP LOCKOUT OPENING THE UNIT GENERATOR OUTPUT BREAKERS

-THE FIRST HIT PANEL ON ELECTRO-HYDRAULIC CONTROL (EHC) CONFIRMS THE MANUAL TRIP FOLLOWED BY THE CUSTOMER TRIP SIGNALS

WITH THE GENERATOR LOCKOUT, POWER IS LOST TO BUS "1B" -THIS WOULD CAUSE THE LOSS OF BOTH RR, IF NOT TRIPPED ABOVE, AS BUS "1B" DOES NOT AUTOMATICALLY TRANSFER TO THE SAT

RCIC DISCHARGE PRESSURE IS INCREASING, INDICATING A NORMAL START OF RCIC

08:52:50 THE HPCI STEAM STOP VALVE CAME OPEN IN RESPONSE TO THE LOW LEVEL #2

-THE LOWEST REACTOR LEVEL OBSERVED ON THE WIDE RANGE LEVEL CHANNEL IS 117 INCHES

08:52:51 THE HPCI INJECTION VALVE BEGINS TO OPEN AND INJECTION BEGINS.

08:52:52 THE RCIC TURBINE HAS AUTO STARTED AND THE INJECTION VALVE IS
FULL OPEN

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08:52:58 OPERATOR RESETS THE CONTROL SYSTEM LOCKOUT ON THE RFP TURBINE(S), FEED FLOW INCREASES TO MAXIMUM

08:53:03 THE RWCU OUTBOARD ISOLATION VALVE CLOSES AND THE INBOARD VALVE
CLOSES 2 SECONDS LATER

08:53:20 HPCI, RCIC AND THE REMAINING REACTOR FEED PUMP TURBINE TRIP ON
HIGH LEVEL, HIGHEST LEVEL OBSERVED IS 210" ON WIDE RANGE

08:54 THE RFP "A" CONTROL SIGNAL FAILURE ALARM COMES IN AND OUT MANY
TIMES OVER THE NEXT SIX MINUTES
-THIS IS BELIEVED TO BE AN INDICATION OF ERRATIC BEHAVIOR IN THE PRIMARY INVERTOR

CONFIRMATION OF "ALL RODS FULL IN" FROM "NUMAC" ROD WORTH MINIMIZER

08:55 UNIT 2 BYPASSED THE GROUP 6 ISOLATION SIGNAL PER THE EMERGENCY
OPERATING PROCEDURE (EOP) TO RESTORE THE REACTOR BUILDING VENTILATION

09:03 THE GROUP 2, 3, & 6 ISOLATIONS ARE RESET AND RWCU ISOLATION VALVES ARE REOPENED

09:06 ALL CONTROL RODS VERIFIED AT "00" AND LOGGED

THE HI-HI SCRAM DISCHARGE VOLUME IS BYPASSED AND THE REACTOR SCRAM IS RESET

BEGAN FEEDING THE VESSEL WITH RFP "1B" THROUGH THE STARTUP
LEVEL CONTROL VALVE

09:10 RWCU IS PLACED IN SERVICE TO PROVIDE A REJECT PATH AND
RESTORE
INDICATION OF THE REACTOR VESSEL BOTTOM HEAD TEMPERATURE

09:12 BEGAN RECEIVING ANOTHER SERIES OF UPS VOLTAGE TRANSIENTS
RECEIVED MULTIPLE TRIPS AND RESETS OF THE GROUP 6 ISOLATION

09:16 UNSUCCESSFULLY ATTEMPTED TO PLACE UPS ON THE ALTERNATE
SOURCE

THE PRIMARY UPS GAVE INDICATION OF BEING HEAVILY LOADED OR
GROUNDED OUT

ERRATIC BEHAVIOR OF THE UPS OUTPUT CONTINUED

09:21 ERRATIC OPERATION IS NOTED ON THE EHC SYSTEM

-SINCE THE TURBINE IS TRIPPED, THE MAIN GENERATOR PERMANENT
MAGNET GENERATOR CANNOT SUPPLY POWER TO THE BACKUP
ELECTRICAL
SYSTEM, AND UPS IS NOW PROVIDING CONTROL POWER

EHC HYDRAULIC PUMPS ARE SECURED AND THE REMAINING STEAM
LOADS
ARE ADEQUATE FOR REACTOR PRESSURE CONTROL

-AS DESIGNED THE MAIN STEAMLIN ISOLATION VALVES REMAINED
OPEN
AND THE PRIMARY HEAT SINK REMAINED THE MAIN CONDENSER

09:22 REACTOR PROTECTION SYSTEM TRIP (NO ROD MOTION) RECEIVED
ON LOW
LEVEL #1. RFP CONTROL KEEPS LOCKING OUT ON LOSS OF CONTROL
SIGNAL MAKING STEADY REACTOR VESSEL LEVEL CONTROL IMPOSSIBLE
WITH THE FEED WATER SYSTEM

GROUPS 2, 6, AND 8 ISOLATION SIGNALS RECEIVED AND THE GROUP 6
ISOLATION VALVES CLOSE

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09:23 RCIC MANUALLY STARTED FOR REACTOR LEVEL CONTROL

09:24 MAIN STEAMLINE DRAINS ARE OPENED TO AID IN REACTOR LEVEL CONTROL

SHIFT SUPERVISOR, UNIT MANAGER, AND SHIFT TECHNICAL ADVISOR
EVALUATE PLANT EMERGENCY PLAN (PEP) ENTRY

-THE PURPOSE WOULD BE TO INCREASE THE PLANT PERSONNEL
AWARENESS
OF THE EVENT

-THIS ACTION WAS DEEMED UNNECESSARY AND NO OTHER ENTRY
CONDITIONS WERE MET

09:26 BASED ON THE UNUSUAL NOISES IN THE UPS INVERTOR, THE FIRE
BRIGADE WAS ACTIVATED AS A PRECAUTIONARY MEASURE

-THERE WERE NO REPORTS OF FIRE, SMOKE OR OVERHEATING

-AS THIS WAS A PRECAUTIONARY MEASURE, WE DID NOT MEET THE
CONDITION FOR ENTRY INTO THE PEP

09:30 RESET GROUPS 2 & 6

GROUP 6 WAS RESET TO PLACE THE "CAC" MONITORS IN SERVICE AND
VENT THE DRYWELL

09:34 PER THE EOP'S "B" LOOP RESIDUAL HEAT REMOVAL (RHR) WAS
PLACED
IN TORUS COOLING TO SUPPORT HPCI AND RCIC OPERATION

09:35 VENTED THE DRYWELL

09:40 CLOSED THE MAIN STEAMLINE DRAIN VALVES

09:41 ERRATIC OPERATION OF UPS RESULTS IN A GROUP 6 ISOLATION AT
THIS
POINT UPS BECAME REASONABLY STABLE AND NO FURTHER ATTEMPTS
WERE
MADE TO TRANSFER FROM THE PRIMARY UPS TO THE ALTERNATE
SOURCE

09:45 RESTORED REACTOR BUILDING VENTILATION ON UNIT 1 AND RESET
THE
GROUP 6 ISOLATION

09:53 RFP "1B" AVAILABLE TO FEED THE REACTOR VESSEL

09:58 RCIC SECURED AT ABOUT 200" AND USING TWO CRD PUMPS WITH
MAXIMIZED FLOW TO CONTROL REACTOR VESSEL LEVEL

10:17 CRD IS UNABLE TO MAINTAIN LEVEL WHICH DROPS BELOW THE LOW
LEVEL

#1 SETPOINT. THIS RESULTS IN A RPS TRIP, GROUP 6 ISOLATION,
AND GROUPS 2 AND 8 ISOLATION SIGNALS

-AS THE REACTOR SCRAM WAS STILL PRESENT AND THE PROCESS
COMPUTER WAS NO LONGER AVAILABLE TO AUTOMATICALLY LOG THIS
EVENT IT WAS OMITTED FROM THE INITIAL FOUR HOUR REPORT (THIS
OMISSION WAS CORRECTED AT 1505)

10:18 "1B" RFP WAS PLACED IN SERVICE TO FEED THE REACTOR VESSEL
THROUGH THE STARTUP LEVEL CONTROL VALVE

-NORMAL LEVEL CONTROL WAS ESTABLISHED

10:24 THE GROUP 2 AND 6 ISOLATIONS WERE RESET

10:25 THE GROUP 6 ISOLATION VALVES FOR DRYWELL
HYDROGEN/OXYGEN
MONITOR WERE OPENED

10:30 THE GROUP 2 ISOLATION VALVES WERE OPENED

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10:49 THE RPS TRIP WAS RESET

10:50 MAIN STACK RADIATION MONITOR GRAB SAMPLES TAKEN AND
AUXILIARY
SAMPLING ESTABLISHED

13:11 RFP "1B" TRIPPED ON HIGH LEVEL, AND REACTOR VESSEL LEVEL
CONTROL WAS MAINTAINED WITH THE CRD SYSTEM

14:25 RFP "1B" PLACED IN SERVICE FEEDING THE VESSEL

15:03 UPS IS TRANSFERRED TO THE ALTERNATE SOURCE USING THE
MANUAL
BYPASS SWITCH

16:08 THE LATE 4 HOUR RED PHONE REPORT IS MADE FOR THE 10:17 LOW
LEVEL #1 RPS TRIP AND ISOLATIONS

END OF EVENT

DATE 1/19/92

13:09 REACTOR MODE SWITCH PLACED IN STARTUP

16:52 UNIT 1 REACTOR IS CRITICAL

ATTACHMENT 1 TO 9202260086 PAGE 1 OF 1

CP&L

Carolina Power & Light Company

Brunswick Nuclear Project
P. O. Box 10429
Southport, N.C. 28461-0429

FEB 18 1992

FILE: B09-13510C 10CFR50.73

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D. C. 20555

BRUNSWICK STEAM ELECTRIC PLANT UNIT 1
DOCKET NO. 50-325
LICENSE NO. DRP-71
LICENSEE EVENT REPORT 1-92-003

Gentlemen:

In accordance with Title 10 of the Code of Federal Regulations, the enclosed Licensee Event Report is submitted. This report fulfills the requirement for a written report within thirty (30) days of a reportable occurrence and is submitted in accordance with the format set forth in NUREG-1022, September 1983.

Very truly yours,

J. W. Spencer, General Manager
Brunswick Nuclear Project

GT/

Enclosure

cc: Mr. S. D. Ebnetter
Mr. N. B. Le
BSEP NRC Resident Office

*** END OF DOCUMENT ***
